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ABSTRACT

To provide information to support school district considerations of changes in mathematics and science instruction, three issues were considered: (1) the adequacy of the California Basic Education Data System (CBEDS) for supporting an analysis of subject matter instruction; (2) the distribution of teaching effort and student enrollments among science and mathematics courses; and (3) subject matter coverage as reflected by textbook use. Some discrepancies were found between data from a special survey and the CBEDS, but these were not of sufficient magnitude to justify the costs of collecting new data. Therefore, CBEDS data for 1982 were used to analyze enrollments and levels of teaching effort for mathematics and science courses in grades 9-12. Mathematics accounted for 12.6% of the enrollments and 13.3% of the effort, while the data for science were 6.4% and 6.5%, respectively. Course content was examined, using beginning algebra for the textbook analysis. On the average, about two-thirds of the lessons in the four textbooks were devoted to topics in the state competencies statement. While the structure and content were similar, differences in textbooks were also noted. A comparison with SAT content indicated some disparities with the competencies statement. Tables present the data and other information. (MNS)

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Mathematics and Science Instruction in Southern California

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MATHEMATICS AND SCIENCE INSTRUCTION IN SOUTHERN CALIFORNIA

Edwin C. Myers and R. James Mineo

ABSTRACT

To provide information to support school district consideration of changes in mathematics and science instruction, this paper considers three issues: (1) the adequacy of the California Basic Education Data System for supporting an analysis of subject matter instruction; (2) the distribution of teaching effort and student enrollments among science and mathematics courses; and (3) subject matter coverage as reflected by textbook use.

MATHEMATICS AND SCIENCE INSTRUCTION IN SOUTHERN CALIFORNIA

Edwin C. Myers and R. James Mineo

Recent public and professional concern for preserving U.S. leadership in mathematics and science has raised new questions about the extent and quality of secondary school instruction in these subjects.

Ironically, both the expressions of concern and the edicts for change have relied on "seat of the pants" information rather than on information reflecting any sensitivity to mathematical and scientific orientations. It is possible but not prudent to critique and change characteristics of mathematics and science instruction while ignorant regarding such matters as the set of courses involved, course enrollments, instructional texts, and achievement tests.

To generate information that can provide an adequate management foundation for considering and/or effecting changes in mathematics and science instruction is beyond the capability of a single investigator or institution. For this reason, the Southern California School Districts Superintendents' Research Council, a consortium of 20 districts, and SWRL, the regional educational laboratory for Arizona, Nevada, and Southern California are conducting a multiorganizational inquiry for that purpose. The results of the inquiry are being reported as analyses are completed. The present paper considers three issues that have been illuminated by the analysis to date: (1) the adequacy of the California Basic Education Data System for supporting an analysis of subject matter instruction; (2) the distribution of teaching effort and student enrollments among science and mathematics courses; and (3) subject matter coverage as reflected by textbook use.

Data Base Adequacy

It is always possible to conduct a new survey to collect education data, and it has been the tradition to do so each time new information is sought. However, considerable savings in terms of both time and money will be realized if the information can be retrieved from an existing data base. Information on staff effort and enrollment is collected each October for the California Basic Education Data Systems (CBEDS). While these data were not collected for the particular purpose of this investigation, an analysis was conducted to determine if the CBEDS data would be adequate for this purpose. Since questions previously had been raised by the Council and others regarding the reliability and usefulness of CBEDS data, this preliminary investigation seemed appropriate.

To answer questions about the usefulness of the CBEDS data, a comparison was made between information provided by a small independent survey of a number of Southern California school districts and the corresponding data contained in CBEDS. Comparisons (165) were made between course codes assigned by teachers for CBEDS and codes assigned by district administrators in response to the survey. Errors were considered to be present whenever CBEDS recorded a code that was not present in the district survey or the district survey recorded a code not in CBEDS. Of the 28 such errors, nine were found to be in the categories of conservation, earth sciences, environment, and oceanography, which are subjects related to each other. Five of the errors were found to be in the classification of trigonometry either by itself or with intermediate algebra. And three of the errors were found in the classification of

gifted and talented programs where the course might be titled either by its content or by the gifted and talented classification. This left only 11 possible discrepancies unaccounted for. In general, the analysis indicated that while there were some discrepancies between the special survey data and the CBEDS data, these discrepancies were not highly consequential, and were certainly not of sufficient magnitude to justify the costs of a new data collection effort.

Teaching Effort and Enrollment in Secondary Science and Mathematics Courses

Using the CBEDS data for 1982, an analysis of the enrollment and level of teaching effort for secondary mathematics and science courses in grades 9-12 was performed. For mathematics, Table 1 presents the number of teaching assignments (ordinarily classes), full-time equivalent (FTE) teaching staff, and enrollments aggregated for the Council districts.[1] Table 2 presents the same information for science courses.

Mathematics accounted for 12.6% of the course enrollments and 13.3% of the teaching staff effort for grades 9-12 in the Council Districts. In science these percentages were 6.4 and 6.5 respectively.

An inspection of Tables 1 and 2 shows that both in mathematics and science, two or three courses accounted for more than half of the student enrollments with six courses accounting for approximately 80%. Only about 10% of the enrollments in either science or mathematics could be

[1]Data were not available for one of the twenty districts.

considered advanced courses. In addition, within mathematics, more than 10% of the instruction was allocated to courses classified as remedial.

Recommendations for increasing the amount of science and mathematics instruction in the high schools has raised the question of where these additional teachers might be found. One possible source was explored. People who teach mathematics and science have other assignments as well. Presumably people who already teach some mathematics or science would be candidates for teaching additional courses, if they could be relieved of their other assignments. Table 3 presents the allocation of effort for all people who teach at least one mathematics course. Table 4 presents the same information for people who teach at least one science course. People who teach at least one mathematics or science course have approximately 1/3 of their time assigned to other activities.

During the past several years, there has been an increasing interest in various types of computer education. With the collection of the 1982 CBEDS data, eight new assignment categories were added for computer education (2450 to 2459). In the previous years, only one assignment category (2412) was included. In 1981, the 2,164 enrollments in computer programming/science comprised 0.9% of the enrollments in mathematics. In 1982, the combination of all computer education enrollments had increased by 0.6% to a total of 1.5% of the mathematics enrollments. Although there is still only limited teaching effort and enrollment in computer education courses, it is likely that other courses have some computer-related instruction.

Course Content

In addition to examining the distribution of enrollments and effort allocated to the categories of courses identified by the CBEDS codes, analyses were conducted to provide some information about the content of these categories. A survey of the Council districts requested information regarding the textbooks used in the courses offered by the districts.

Course titles. Since a number of courses could be classified within the same CBEDS category, an examination of the course titles was made. Table 5 presents for each CBEDS mathematics category the course titles identified by district staff. Table 6 presents the same information for science courses. An examination of these tables shows that while there are a fairly large number of individual course titles, with few exceptions the course titles within each CBEDS code are quite similar.

Course textbook. Another indicator of the content of the CBEDS course categories is the textbook being used. Table 7 presents the textbooks used in the various courses within each CBEDS code for mathematics. Table 8 presents the same information for science courses. The number of different textbooks is particularly evident in those categories for which enrollments are highest.

Textbook content. In view of the number of textbooks identified with categories of courses an additional analysis was performed in order to explore possible variations in content among texts within a particular classification. The course selected for this analysis was beginning algebra. Beginning algebra or algebra I is typically required for

college admission and is a prerequisite for most advanced mathematics. It is the most frequently taken mathematics course and accounts for more than 20% of the total mathematics course enrollments. The academic senates of the California Community Colleges, the Califorinia State University, and the University of California have published a statement of the competencies expected of entering freshmen as a result of a beginning algebra course in high school.

Four textbooks widely used in Southern California were selected for this analysis. In addition, three of these texts were examined based on the minimum average and maximum course sequences as defined by the teacher's edition. In all, ten courses of study were examined.

The topics identified in the academic senates' competencies statement were used to compare the content coverage of the textbooks. Each textbook was examined page by page and the number of lessons allocated to each topic in the competencies statement was recorded. When textbooks addressed topics not included in the competencies statement, these topics were also noted. In addition, a record was made of the sequence in which topics were introduced by recording the lesson number in which a topic first appeared. The texts examined made provision for either 160 or 170 lessons during the year. Table 9 presents the lesson number in which a topic was first introduced, and Table 10 presents the percentage of lessons for each topic.

In these tables, the first 12 topics corresponds to those in the Academic Senates' competencies statement. Sample problems for these topics can be found in Table 11. Topics 13 through 23 are topics not included in the competencies statement.

In general, the courses tended to be similar in their sequencing of topics. That is, topics appearing early in one course were most often found at the beginning of other courses. In addition, the topics included in the competencies statement tended to be covered earlier than topics not included in the statement. The textbooks had similar structures.

On the average, about 2/3 of the lessons were devoted to the topics in the competencies statement with the remaining third divided between additional topics and review and testing. Topics heavily emphasized by one text also tended to be emphasized by the others.

While the structure and content of the courses were in general similar, there were also differences among textbooks and among courses within a textbook. For example, the Houghton Mifflin text provides only about 1/3 of the amount of instruction on linear equations and their graphs as the other texts do, and within the Harcourt Brace Jovanovich text, the minimum course omits instruction in quadratic equations while the average and maximum courses provide approximately four days of instruction.

SAT Content. In addition to comparing the topics and examples contained in the competencies statement with four textbook samples, the analysis also included a comparison of the statement with sample SAT exams. Baron's "How to Prepare for the Scholastic Aptitude Test" (Eleventh Edition) was used to sample the algebra items that typically appear on the mathematics sections of the SAT. The intent of this comparison was to identify similarities and/or differences among the expected competencies of entering college freshmen, the textbook

coverage, and the specific skills and test items that are used to assess the requisites for college entrance.

The sample SATs include a very high percentage of application problems, as compared with the corresponding amount of practice in all four textbooks reviewed. This means that students will encounter items that test certain competencies, but in an application format. For example, simple linear equations in textbooks typically take the form $x = 2(\frac{1}{2})(2\frac{1}{2}) + 2\frac{1}{2}$, whereas the corresponding SAT example is: "if two halves of $2\frac{1}{2}$ are added to $2\frac{1}{2}$, the result is ___." The former is a straightforward operation using literal symbols, while the latter requires translating the words into symbols first.

Among the Algebra I competencies identified by the Academic Senates, the sample SATs examined include items that bear only indirect resemblance to either the corresponding instruction in the textbooks reviewed, or to the sample items provided in the the Senates' statement. Table 12 contrasts corresponding sample items from among the competencies statement, the textbooks reviewed, and the SAT.

Since both the competencies statement and the SAT are intended to represent standards for college admission, discrepancies between them could have important implications for high school instruction. Additional analysis will be required to determine the relationships among the college entrance standards, the most widely used entrance examinations and the content of the popular high school textbooks. If high schools are to have confidence that their instructional programs are providing adequate preparation for college work, the requirements of both the college faculty and the entrance examinations must be understood.

Table 1

Assignments, Enrollments, and Teaching Effort for Grades 9-12 Mathematics Courses for SCRC Districts

		Assignments		Enrollments		Staff (FTE's)	
		F	%	F	%	F	%
2400	General/basic math (9-12)	1,417	14.9	41,568	15.4	260.3	15.1
2401	Consumer/senior math (11-12)	822	8.6	24,277	9.0	139.8	8.1
2402	Remedial math/math lab	1,101	11.6	28,160	10.4	189.2	11.0
2403	Beginning algebra	2,075	21.8	68,708	25.4	363.6	21.1
2404	Intermediate algebra	438	4.6	14,002	5.2	77.1	4.5
2405	Plane geometry	1,014	10.7	32,702	12.1	178	10.3
2406	Solid geometry	12	0.1	514	0.2	2.6	0.2
2407	Trigonometry	175	1.8	5,060	1.9	30.6	1.8
2408	Inter. algebra/trigonometry	218	2.3	6,831	2.5	37.9	2.2
2409	Solid geometry/trigonometry	2	0.0	72	0.0	0.4	0.0
2410	Probability/statistics	2	0.0	35	0.0	0.3	0.0
2411	Modern algebra	25	0.3	903	0.3	4.6	0.3
2412	Computer programming/science	92	1.0	2,422	0.9	16.6	1.0
2413	Advanced placement math	79	0.8	1,843	0.7	13.3	0.8
2414	Analytic geom./pre-calculus	48	0.5	1,377	0.5	8.9	0.5
2415	Calculus	45	0.5	1,090	0.4	7.6	0.4
2416	Gifted and talented	97	1.0	2,732	1.0	16.3	0.9
2450	Computer literacy	12	0.1	429	0.2	2.6	0.2
2451	Computer programming	23	0.2	849	0.3	5.9	0.3
2452	Data processing	3	0.0	72	0.0	0.5	0.0
2453	Computer science	5	0.1	143	0.1	1	0.1
2455	Computer accounting	0	0.0	0	0.0	0	0.0
2455	Word processing	3	0.0	41	0.0	0.8	0.1
2458	Other computer education	5	0.1	117	0.0	0.7	0.0
2459	Computer department chair	0	0.0	NA	NA	0	0.0
2498	Other mathematics course	1,362	14.3	36,389	13.5	229.6	13.3
2499	Mathematics department chair	434	4.6	NA	NA	137	7.9
	Total	9,509	100.0	270,336	100.0	1,725.2	100.0

Table 2

Assignments, Enrollments, and Teaching Effort for Grade 9 Science Courses for SCRC Districts

		Assignments		Enrollments		Staff (FTE's)	
		F	%	F	%	F	%
2600	Astronomy	8	0.2	216	0.2	1.4	0.2
2601	Aerospace education	19	0.4	542	0.4	3.0	0.4
2602	Aviation education	4	0.1	122	0.1	0.7	0.1
2603	Biology	1,604	33.6	51,114	35.5	279.3	33.1
2604	Advanced biology	92	1.9	2,714	1.9	16.1	1.9
2605	Botany	12	0.3	305	0.2	2.0	0.2
2606	Zoology	7	0.2	307	0.2	1.3	0.2
2607	Chemistry	474	9.9	14,168	9.8	83.4	9.9
2608	Advanced chemistry	52	1.1	1,267	0.9	8.8	1.0
2609	Oceanography	99	2.1	3,180	2.2	17.0	2.0
2610	Physical science	184	3.8	6,102	4.2	33.3	4.0
2611	General science	808	16.9	24,595	17.1	138.7	16.4
2612	Enviornmental studies	11	0.2	314	0.2	1.9	0.2
2613	Physics	209	4.4	5,691	4.0	37.4	4.4
2614	Advanced physics	34	0.7	693	0.5	5.8	0.7
2615	Anatomy	7	0.2	164	0.1	1.2	0.1
2616	Archeology	0	0.0	0	0.0	0.0	0.0
2617	Conservation	0	0.0	0	0.0	0.0	0.0
2618	Earth science	119	2.5	3,731	2.6	21.1	2.5
2619	Energy education	1	0.0	27	0.0	0.2	0.0
2620	Geology	6	0.1	150	0.1	1.0	0.1
2621	Life science	471	9.9	15,377	10.7	83.5	9.9
2622	Meteorology	1	0.0	0	0.0	0.2	0.0
2623	Physiology	202	4.2	6,279	4.4	34.4	4.1
2624	Science projects	6	0.1	142	0.1	1.0	0.1
2625	Space science	0	0.0	0	0.0	0.0	0.0
2626	Gifted and talented	23	0.5	633	0.4	3.9	0.5
2698	Other sciencs courses	247	5.2	6,339	4.4	47.4	5.6
2699	Science department chair	74	1.5	NA	NA	19.8	2.3
	Total	4,774	100.0	144,172	100.0	843.8	100.0

Table 3

Allocation of Effort for Mathematics Teachers
1982-1983

	Staff (FTE's)	
	F	%
English	194.6	5.0
Foreign Language	23.7	0.6
Mathematics	2,470.6	63.0
Physical education, health, and safety	130.5	3.3
Science	138.9	3.5
Social Science	118.8	3.0
Fine and Performing Arts	61.0	1.5
Vocational Education	146.5	3.7
Instruction related (e.g., homeroom, study hall)	547.9	14.0
Administration & other nonteaching	54.5	1.4
Other	37.0	0.9
Total	3,924.0	100.0

Table 4

Allocation of Effort for Science Teachers
1982-1983

	Staff (FTE's)	
	F	%
English	61.7	3.3
Foreign Language	5.3	0.3
Mathematics	129.2	6.8
Physical education, health, and safety	108.3	5.7
Science	1,192.9	63.2
Soial Science	46.3	2.5
Fine and Performing Arts	20.3	1.1
Vocational Education	36.8	2.0
Instruction related (e.g., homeroom, study hall)	252.4	13.4
Administration & other nonteaching	20.4	1.1
Other	14.5	0.8
Total	1,888.1	100.0

Table 5

District Course Titles in Mathematics by CBEDS Code

1402 - MATHEMATICS/PRE-ALGEBRA (gr 7-8)

Pre-Algebra
Algebra 1A

1403 - BEGINNING ALGEBRA (gr 7-8)

Algebra 1B
Algebra 1/2

2400 - GENERAL MATHEMATICS/BASIC MATHEMATICS (gr 9-10)

General Math
General Mathematics I
General Mathematics II
Basic Mathematics
Practical Mathematics
High School Math
Liberal Arts Math
Math Skills
General Mathematics/Basic Mathematics
Mathematics 9
Applied Math
Metric System 1
Industrial Mathematics
Industrial Mathematics 2AB
Statistics
General Mathematics 1-2
Consumer Mathematics 1, 2

2401 - CONSUMER MATHEMATICS/SENIOR MATHEMATICS (gr 11-12)

Consumer Mathematics
Consumer Mathematics/Senior Mathematics

Table 5 (continued)

Consumer/Career Math A/B
Senior Mathematics
Career Mathematics 1,2
Mathematics Improvement 1,2

2402 - REMEDIAL MATHEMATICS/MATH LABS (any of gr 7-12)

Pre-Algebra
Math Lab
Competency Math
Developmental Mathematics 1-4
Basic Mathematics
Practical Mathematics
Proficiency Skills
Basic Math Skills
Remedial Mathematics/Math Labs
ESL Mathematics
Mathematics B
Fundamental Math
Mathematics 9 AB
Senior Mathematics
Calculating A
History of Mathematics
Informal Geometry
Junior High Mathematics Lab
Junior Navigation
Math Skills ASC
Pre-Engineering Mathematics
Problem Solving 1
Application of Mathematics AB
Basic Math (Special) AB
Math Skills Topics
Mathematics Laboratory AB

Table 5 (continued)

2403 - BEGINNING ALGEBRA (any of grade 9-12)

Algebra I
Algebra I (Honors)
Algebraic Concepts
Algebra 1/2
Beginning Algebra
Algebra 1/1 Honors
Algebra 1AB
Algebra 1C
Algebra Experiences ABCD
Algebra S
Algebra S-AB
Basic Algebra 1-2
Algebra 1-2
Basic Algebra 3-4

2404 - INTERMEDIATE ALGEBRA

Algebra II E (Enriched)
Algebra II
Intermediate Algebra
Algebra 2H
Algebra 2AB
Plane Geometry/Intermediate Algebra
Advanced Mathematics 3-4
Intermediate Algebra 1-2

2405 - PLANE GEOMETRY

Geometry
Plane Geometry
Geometry (Honors)
Geometry 1/2
Geometry H
Geometry/Geometry Honors

Table 5 (continued)

Geometry AB
Liberal Arts Geometry AB
Plane Geometry/Intermediate Algebra
Geometry 1-2
Advanced Mathematics 5-6

2406 - SOLID GEOMETRY

Solid Geometry (Enriched)
Solid Geometry

2407 - TRIGONOMETRY

Trigonometry
Trigonometry and Advanced Topics
Trigonometry 1

2408 - INTERMEDIATE ALGEBRA/TRIGONOMETRY

Algebra II
Algebra II/Trigonometry
Algebra 3
Intermediate Algebra/Trigonometry
Algebra 2/2 Honors
Advanced Alebgra and Trigonometry AB

2409 - SOLID GEOMETRY/TRIGONOMETRY

Trigonometry
Solid Geometry/Trigonometry
Trigonometry/Analytic Geometry

2410 - PROBABILITY/STATISTICS

Probability and Statistics
Probability and Statistics 1

Table 5 (continued)

2411 - MODERN ALGEBRA

Modern Algebra

2412 - COMPUTER PROGRAMMING/SCIENCE[1]

Computer Programming
Computer Concepts
Computer Programming Science
Computer Math
Computer Literacy
Computer Programming 1AB
Computer Programming 2AB
Computer Technology A
Computer Programming 3AB
Computer Programming 4AB
Computer Science 1,2
Computer Applications

2413 - ADVANCED PLACEMENT MATHEMATICS (gr 11-12)

Advanced Placement Math
Advanced Placement Calculus 1AB
Advanced Placement Calculus 2AB
Advanced Mathematics 7-8

2414 - ANALYTIC GEOMETRY/PRE-CALCULUS

Analytical Geometry
Pre-Calculus (Enriched)
Modern Math Analysis (Enriched)
Calculus
Computer Programming
Functional Mathematic Analysis
Math Analysis
Algebra 4
Algebra 5
Analytic Geometry/Pre-Calculus

[1] Since 1981 assignment codes were used in the survey, no data were available for the new 1982 computer categories.

Table 5 (continued)

Trigonometry and Analytic Geometry
Introductory Mathematics Analysis
Mathematical Analysis AB
SAT Mathematics
Symbolic Logic
Trigonometry and Advanced Topics
Pre-Calculus 1
Analytic Geometry 1

2415 - CALCULUS

Calculus
Analytic Geometry and Calculus
Introductory Calculus/Honors
Math 160-61 Honors Calculus

2416 - MATHEMATICS, GIFTED TALENTED

Mathematics, Gifted, Talented
Mathematics 9 AB
Algebra 1AB
Geometry AB
Mathematics 8C
Mathematics 9AB (CSMP)
Mathematics 9AB (SSMCIS)
Mathematics 10AB (CSMP)
Mathematics 10AB (SSMCIS)
Mathematics 11AB (CSMP)
Mathematics 11AB (SSMCIS)
Mathematics 12AB (SSMCIS)

2498 - OTHER

Technical Mathematics 1-2
Trigonometry and Advanced Algebra 1-2
Mathematics for College Entrance 1,2
Finite Mathematics 1
Advanced Algebra 1

Table 6

District Course Titles in Science by CBEDS Code

2600 - Astronomy

Astronomy

2601 - Aerospace Education

Aerospace Education

2602 - Aviation Education

Aeronautics AB
Aviation Education
Aviation Science

2603 - Biology

Advanced Placement Biology AB
Basic Biology 1, 2
Biology
Biology 1, 2
Biology AB
Botany
General Science 3, 4
Marine Biology AB

2604 - Advanced Biology

Advanced Biology
Advanced Biology 1, 2
Advanced Biology AB
Biology (A-P)
Biology 10
Biology 3, 4

2605 - Botany

Plant Science

2606 - Zoology

Advanced Biology C
Zoology

2607 - Chemistry

Advanced Placement Chemistry AB
Applied Chemistry 1, 2
Applied Chemistry AB

Table 6 (continued)

2607 - Chemistry (continued)

Basic Chemistry
Chemistry
Chemistry 1-2
Chemistry AB
Chemistry H
General Science 3, 4

2608 - Advanced Chemistry

General Science 1, 2
Advanced Chemistry
Advanced Chemistry 1-2
Chemistry (Enriched AP)

2609 - Oceanography

Advanced Biology B
Marine Science A/B
Oceanography

2610 - Physical Science

Advanced Physical Science AB
Basic Physical Science, IPS
Introduction to Laboratory Science
Physical Science

2611 - General Science

General Science
General Science 1, 2
Investigations in Science
Modern Biology AB
Modern Science Biology AB
Science 9
Science Fundamentals
Science Problems 1, 2

2612 - Environmental Studies

Challenges to Science: Life Science
Elementary Ecology
Environmental Studies
Horticulture Science
Life Science

2613 - Physics

Advanced Placement Physics AB
Physics
Physics 1, 2
Physics AB
Project Physics AB

Table 6 (continued)

2614 - Advanced Physics

Advanced Physics
Honor Physics 1, 2
Physics (Enriched AP)

2615 - Anatomy

Anatomy
Human Anatomy and Physiology
Physiology 1, 2

2616 - Archeology

Archeology

2618 - Earth Science

Earth Science

2619 - Energy Education

Basic Science Matter and Energy
Energy Education
Matter and Energy

2620 - Geology

Geo-Science
Geology
Geology 1/2

2621 - Life Science

Basic Science Life
Life Science
Life Science AB
Living Science

2622 - Meteorology

Meteorology

2623 - Physiology

Human Organisms
Physiology
Physiology AB

2624 - Science Projects

Lab Assistance
Lab Assistance, Biology
Lab Assistance, Chemistry
Lab Assistance, Physics
Practical Science
Science Projects

Table 6 (continued)

2625 - Space Science

Space Science

2626 - Science, Gifted and Talented

Science, Gifted and Talented

2698 - Other

Basic Science Health
Basic Science Microbes and Disease
Biological Bases of Human Behavior 1
Biomedical Technician Studies AB
Environmental Studies AB
Health Education
Man-Made World AB
Marine Biology
Physical Anthropology
Science Seminar

Table 7

Math Texts by CBEDS

1402 - Mathematics/Pre-Algebra (gr 7-8)

Bramson. Algebra: An Introductory Course. Amsco, 1978.

Denholm, et al. Elementary Algebra, Part 1. Houghton Mifflin, 1970.

Jacobs. Introductory Algebra. Harcourt, Brace, Jovanovich, 1976.

Nichols, et al. Holt Pre-Algebra. Holt, Rinehart, Winston, several editions.

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1403 - Beginning Algebra (gr 7-8)

Jacobs. Introductory Algebra II. Harcourt, Brace, Jovanovich, 1976.

Nichols, et al. Holt Algebra 1. Holt, Rinehart, Winston, 1974.

2400 - General Mathematics/Basic Mathematics (gr 9-10)

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2401 - Consumer Mathematics/Senior Mathematics (gr 11-12)

Bolster, Woodburn, Gipson. Consumer and Career Mathematics. Scott Foresman, 1983.

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2402 - Remedial Mathematics/Math Labs (any of gr 7-12)

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2403 - Beginning Algebra (any of grade 9-12)

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2404 - Intermediate Algebra

Allendoerfer. Principals of Mathematics. McGraw Hill, 1969.

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2405 - Plane Geometry

Banks. Geometry. Webster-McGraw, 1972.

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Jurgensen, et al. Modern School Mathematics: Geometry. Houghton Mifflin, several editions.

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Nichols, et al. Holt Geometry. Holt, Rinehart, Winston, 1974.

Peters, Schaaf. Fundamentals of Geometry. American Book Company, 1972.

Ulrich, Czarnec, Guilbault. Geometry. Harcourt, Brace, Jovanovich, 1978.

Wetchons. New Plane Geometry. Ginn, 1958.

Wetchons. Trigonometry with Tables. Ginn, 1957.

Wilcox. Geometry, A Modern Approach. Addison Wesley, 1974.

2406 - Solid Geometry

Jurgensen, et al. Geometry. Houghton Mifflin, 1980.

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2407 - Trigonometry

Coxford. Trigonometry. Harcourt, Brace, Jovanovich, 1982.

Dressler, Rich. Trigonometry. Amsco, 1975.

Nichols. Modern Trigonometry. Holt, Rinehart, Winston, 1968.

Wooton, et al. Modern Trigonometry. Houghton Mifflin, 1973.

2408 - Intermediate Algebra/Trigonometry

Dolciani. Modern School Mathematics: Algebra 2 and Trigonometry, Book 2. Houghton Mifflin, several editions.

Foster, Rath, Winters. Algebra II with Trigonometry. Merrill, 1979.

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Nichols, et al. Holt Algebra 2, with Trigonometry. Holt, Rinehart, Winston, 1978.

2409 - Solid Geometry/Trigonometry

Payne. Trigonometry and Circular Functions. Harcourt, Brace, Jovanovich, 1972.

Wooton, et al. Modern Trigonometry. Houghton Mifflin, 1973.

2410 - Probability/Statistics

Willoughby. Probability and Statistics. Silver Burdett, 1968.

2411 - Modern Algebra

Dolciani, et al. Algebra: Structure and Method, Book 1. Houghton Mifflin, 1981.

2412 - Computer Programming/Science

Albrecht, et al. Basic for Home Computer. Wiley, 1978.

Dwyer, Critchfield. Basic and the Personal Computer. Addison Wesley, 1978.

Golden. Computer Programming in the Basic Language. Harcourt, Brace, Jovanovich, 1975.

2413 - Advanced Placement Mathematics (gr 11-12)

Brown. Advanced Mathematics: An Introductory Course. Houghton Mifflin, 1978.

Coxford, Payne. Advanced Mathematics: A Preparation for Calculus. Harcourt, Brace, Jovanovich, 1978.

Leithold. The Calculus with Analytic Geometry, Part 1. Harper and Row, 1976.

Riddle. Calculus and Analytic Geometry. Wadsworth, 1974.

Shanks, Gambili. Calculus, Analytic Geometry/Elementary Functions. Holt, Rinehart, Winston, 1973.

Thomas. Elements of Calculus and Analytic Geometry. Addison Wesley, 1976.

2414 - Analytic Geometry/Pre-calculus

Buchanan. Limits. Houghton Mifflin, 1970.

Coxford, Payne. Advanced Mathematics: A Preparation for Calculus. Harcourt, Brace, Jovanovich, 1972.

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Dolciani. Modern Intro Analysis. Houghton Mifflin, 1970.

Ellis. Statistical Inference. Prentice Hall, 1975.

Fuller. Analytical Geometry. Addison Wesley, 1979.

Gold, Carlbert. Modern Applied Mathematics. Houghton Mifflin, 1971.

Gordon, Fuller. Plane Trigonometry with Tables. McGraw Hill, 1978.

Protter, Morrey. Analytic Geometry. Addison Wesley, 1966.

Shanks, Brumfield, Fleenor, Eicholz. Pre-Calculus Mathematics. Addison Wesley, several editions.

Smith. Precalculus Mathematics. Wadsworth, 1979.

Sorgenfrey, Beckenbach. Analysis of Elementary Functions. Houghton Mifflin, 1980.

Wetchons, et al. Modern Trigonometry. Ginn, 1962.

Wooten, et al. Modern Analytic Geometry. Houghton Mifflin, 1981.

Wooton, et al. Modern Trigonometry. Houghton Mifflin, 1973.

2415 - Calculus

Coxford, Payne. Advanced Mathematics: A Preparation for Calculus. Harcourt, Brace, Jovanovich, 1972.

Crowell. Calculus with Analytic Geometry. Norton, 1968.

Leithold. Calculus with Analytic Geometry. Harper and Row, 1976.

Protter, Morrey. Calculus with Analytic Geometry. Addison Wesley, 1963.

Swokowski. Calculus with Analytical Geometry. Prindle, 1979.

Thomas, Finney. Elements of Calculus and Analytic Geometry. Addison Wesley, 1981.

2416 - Mathematics, gifted talented

Brown, Smith, Dolciani. Basic Algebra. Houghton Mifflin, 1980.

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Jacobs. Introductory Algebra. Harcourt, Brace, Jovanovich, 1976.

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Jurgensen, Brown, King. Geometry. Houghton Mifflin, 1980.

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Travers, et al. Using Algebra. Laidlaw, 1974.

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Wilcox. Geometry, A Modern Approach. Addison Wesley, 1974.

2498 - Other

Boyce, et al. Mathematics for Technical and Vocational Schools. Wiley, 1982.

Coxford, Payne. Advanced Mathematics: A Preparation for Calculus. Harcourt, Brace, Jovanovich, 1982.

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Table 8

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2600 - Astronomy

Abell. Exploration of the Universe. Holt, Rinehart, Winston, 1969.

Dixon. Dynamic Astronomy. Prentice Hall, 1971.

2602 - Aviation Education

Bridges. Bridges Aviation Studies. Bridges, 1971.

2603 - Biology

Arms, Camp. Biology. Holt, Rinehart, Winston, 1979.

Biological Science Curriculum Study. Biological Science: An Inquiry Into Life. Harcourt, Brace, Jovanovich, 1980.

Biological Science Curriculum Study. Biological Science: Molecules to Man. Houghton Mifflin, 1968.

Biological Science Curriculum Study. Biological Science: An Ecological Approach (Green Version). Rand McNally, 1964.

Biological Science Curriculum Study. Biological Science: An Inquiry Into Life. Harcourt, Brace, Jovanovich, 1980.

Biological Sciences Curriculum Study. Biological Science: A Molecular Approach (Blue Version). Heath, 1980.

Bishop, Lewis, Sutherland. The Atmosphere and Hydrosphere. Merrill, 1976.

Creager, Jahtzen, Mariner. Macmillan Biology. Macmillan, 1981.

Davis, Solomon. The World of Biology. McGraw-Hill, 1979.

Fitzpatrick. Living Things. Holt, Rinehart, Winston, 1977.

Gross. Oceanography, 4th Edition. Merrill, 1980.

Hollingsworth, Holtz. Biology Study Guide. Holt, Rinehart, Winston, 1979.

Hummer, Kaskel, Kennedy, Oram. Probing Levels of Life, A Laboratory Manual. Merrill, 1979.

ISIS. Individual Science Instruction System: Food and Micro-organisms. Ginn, 1976-77.

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ISIS. Individual Science Instructional System: Implementation Module (Package). Ginn, 1977.

Kaskel, et al. Laboratory Biology, Investigating Living Systems. Merrill, 1979.

McCormack, Miller, Motzko. Scott Foresman Biology, Laboratory Manual. Scott Foresman, 1980.

Metcalfe, et al. Modern Chemistry. Holt, Rinehart, Winston, 1978.

Morholt. Biology: Patterns in Living Things. Harcourt, Brace, Jovanovich, 1976.

Oram, et al. Biology: Living Systems. Merrill, several editions.

Otto, et al. Modern Biology. Holt, Rinehart, Winston, several editions.

Otto, et al. Biology Investigations. Holt, Rinehart, Winston, 1981.

Oxenhorn. Pathways in Biology. Globe, several editions.

Slesnick, et al. Biology. Scott Foresman, 1980.

Sumich. An Introduction to the Biology of Marine Life, 2nd Edition. WMC Brown, 1980.

Teter. Living Things. Holt, Rinehart, Winston, 1977.

Thurman. Introductory Oceanography. Merrill, 1978.

2604 - Advanced Biology

Albersheim, et al. Molecular Basis of Metabolism: A BSCS Laboratory Block. Raytheon Education, 1968.

Biological Science Curriculum Study. Biological Science: Interaction of Experiments and Ideas. Prentice Hall, 1977.

Biological Science Curriculum Study. Biological Science: A Molecular Approach (Blue Version). Heath, 1980.

Curtis. Biology, 3rd Edition. Worth, 1979.

Keeton. Elements of Biological Science, Second Edition. Norton and Company, 1973.

Segal, Gross. Physiological Adaptation: A BSCS Laboratory Block. Heath, 1967.

Slesnick, Balzer, McCormack, Newton, Rasmussen. Scott Foresman Biology. Scott Foresman, 1980.

Webb. Evolution: A BSCS Laboratory Block. Raytheon Education, 1968.

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Weisz. The Science of Biology. McGraw-Hill, 1971.

Weisz, et al. Elements of Biology. McGraw Hill, 1969.

2605 - Botany

Otto, et al. Modern Biology. Holt, Rinehart, Winston, 1981.

2606 - Zoology

Storer, Usinger, et al. General Zoology (5th Edition). McGraw Hill, 1972.

2607 - Chemistry

Lab. Chemistry Study. 1975.

Bolton, et al. Action Chemistry: Matter, Energy and Change. Holt, Rinehart, Winston, 1973.

Gardner, Heikkinen. Interdisciplinary Approaches to Chemistry. Harper Row, 1973.

Greenstone, et al. Concepts in Chemistry. Harcourt, Brace, Jovanovich, 1975.

Himes. Solving Problems in Chemistry. Merrill, several editions.

Kraschwitz. Chemistry, A First Course. McGraw Hill, 1980.

Masterson, Slowinski, Walford. Chemistry. Holt, Rinehart, Winston, 1980.

Metcalfe, et al. Modern Chemistry. Holt, Rinehart, Winston, several editions.

O'Connor, Davis, MacNab, McClellan. Chemistry: Experiments and Principles. Heath, 1982.

Otto, et al. Modern Biology. Holt, Rinehart, Winston, 1977.

Parry, et al. Chemistry: Experimental Foundations. Prentice Hall. 1982.

Smoot, et al. Chemistry, A Modern Course. Merrill, 1979.

Tilbury. Problem Solving in Chemistry. Lyons and Carnahan, 1965.

Toon, et al. Foundations of Chemistry. Holt, Rinehart, Winston, 1970.

Vallarino. Chemistry: A Humanistic Approach. McGraw-Hill, 1975.

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2608 - Advanced Chemistry

Brady. General Chemistry: Principles and Structure. John Wiley and Sons, 1982.

Davis. Laboratory Manual for Chemistry: Experiments and Principles by O'Connor. Heath, 1982.

Greenstone, et al. Concepts in Chemistry. Harcourt, Brace, Jovanovich, 1975.

Himes. Solving Problems in Chemistry. Merrill, 1979.

Masterton. Chemical Principles. Saunders, 1981.

2609 - Oceanography

Bishop, Lewis, Sutherland. The Atmosphere and Hydrosphere. Merrill, 1976.

Oxenhorn, Goldfield. Oceanography and the Future. Globe Books, 1975.

Thurman. Introductory Oceanography. Merrill, 1978.

Weisberg, Parish. Introductory Oceanography. McGraw-Hill, 1974.

Weyl. Oceanography. John Wiley and Sons, 1970.

2610 - Physical Science

Brandwein. Energy--A Physical Science. Harcourt, Brace, Jovanovich, 1980.

Brinkerhoff, et al. The Physical World, 3rd Edition. Harcourt, Brace, Jovanovich, 1968.

Carter. Physical Science: A Problem Solving Approach. Ginn, 1971.

Haber-Schain, et al. Introductory Physical Science. Prentice Hall, several editions.

IPS Group of Educational Services. Introductory Physical Science. Prentice Hall, 1967.

Townsend. Energy, Matter and Change. Scott Foresman, 1973.

Tracy, et al. Modern Physical Science. Holt, Rinehart, Winston, several editions.

Wister. Man and His Physical Universe. John Wiley and Sons, 1963.

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2611 - General Science

Abraham, et al. Interaction of Earth and Time. Rand McNally, 1979.

Berstein, Schachter, Winkler, Wolfe. Concepts and Challenges in Physical Science. CEBCO Standard Publishing, 1978.

Dolmats, Wong. Ideas and Investigations in Science. Prentice Hall, 1976.

Fisk, et al. Physical Sciences, The. Laidlaw, 1971.

Frazier, et al. Biological Sciences, The. Laidlaw, 1974.

Friedl, Kitko. Modern Physical Science. Holt, Rinehart, Winston, 1979.

Galembo, Perkins. Physical Science, Cambridge Work-A-Text. Cambridge (Globe), 1974.

Grasso. Introduction to General Science, Work-A-Text. Globe Books, 1981.

Heimler, Price. Focus on Physical Science. Merrill, 1977.

ISIS. Individual Science Instruction System: Food and Micro-organisms. Ginn, 1976-77.

ISIS. Individual Science Instructional System: Implementation Module (Package). Ginn, 1977.

Larson. Earth and Universe: Earth Science. Cambridge Book, 1976.

Namowitz. Earth Science. American Book Company, 1978.

Ramsey, et al. Holt Earth Science. Holt, Rinehart, Winston, several editions.

Ramsey, et al. Holt General Science. Holt, Rinehart, Winston, 1979.

Ramsey, et al. Holt Life Science. Holt, Rinehart, Winston, 1978.

Ramsey, et al. Holt Physical Science. Holt, Rinehart, Winston, 1978.

Smallwood. Challenges to Science: Life Science. McGraw-Hill, 1978.

Stanger, Perkins. Earth Science, Cambridge Work-A-Text. Cambridge (Globe), 1974.

Thurber, et al. Exploring Life Science. Allyn and Bacon, 1975.

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Warner. Challenges to Science: Life Science. McGraw-Hill, 1978.

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Wong. Biology: Ideas and Investigations in Science. Prentice Hall, 1976.

2612 - Environmental Studies

Lane. Western Garden Book. Sunset, 1967.

Otto, et al. Modern Biology. Holt, Rinehart, Winston, 1973.

Smallwood. Life Science. McGraw Hill, 1978.

2613 - Physics

Exercises and Experiments. Holt, Rinehart, Winston, 1976.

Modern Physics Lab. Workbook. Holt, Rinehart, Winston, 1976.

Physics: Its Methods and Meanings. Allyn and Bacon, 1981.

Genzer, Youngner. Physics. Silver Burdett, 1973.

Haber-Schaim, et al. PSSC Physics. Heath, 1981.

Hewitt. Conceptual Physics. Little, Brown and Company, 1977.

Inman, Miller. Contemporary Physics. Macmillan, 1975.

Miller. College Physics. Harcourt, Brace, Jovanovich, 1977.

Miller, et al. Concepts in Physics. Harcourt, Brace, Jovanovich, several editions.

Murphy, Smoot. Physics: Principles and Problems. Merrill, several editions.

Physical Science Study Committee. Physics. D. C. Heath, 1960.

Rutherford, et al. Project Physics Course Supplemental Units. Holt, Rinehart, Winston, 1975.

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Rutherford, et al. Project Physics, Text and Handbook, Units 1-5. Holt, Rinehart, Winston, 1975.

Williams, et al. Modern Physics. Holt, Rinehart, Winston, 1980.

Woodruff. Terms, Tables and Skills for the Physical Science. Silver Burdett, 1966.

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2614 - Advanced Physics

Harber-Schaim, et al. PSSC Physics. Heath, several editions.

Miller. College Physics, 4th Edition. Harcourt, Brace, Jovanovich, 1977.

Miller, et al. Concepts in Physics. Harcourt, Brace, Jovanovich, 1980.

2615 - Anatomy

Miller, Drakontides, Leavell. Anatomy and Physiology (Kimber-Gray-Stackpoles). Macmillan, 1977.

Tortora. Principles of Anatomy and Physiology in the Laboratory. Burgess, 1976.

Tortora, Anagnostakos. Principals of Anatomy and Physiology. Canfield Press (Harper Row), 1978.

2618 - Earth Science

American Geological Institute. Investigating the Earth. Houghton Mifflin, 1973.

Namowitz. Earth Science. American Book Company, 1978.

Ramsey, et al. Modern Earth Science. Holt, Rinehart, Winston, 1979.

2619 - Energy Education

Bolton, Lampher, Menesini, Huang. Action Chemistry. Holt, Rinehart, Winston, 1973.

Brandwein. Energy: A Physical Science. Harcourt, Brace, Jovanovich, 1975.

Jackson, Evans. Spaceship Earth: Earth Science. Houghton Mifflin, 1976.

Smith, Vance. Science for the Space Age. Lippincott, 1966.

2620 - Geology

Field Guide to Rocks and Minerals. 1953.

Geology Made Simple. 1967.

Bishop, Lewis, Bronaugh. Focus on Earth Science. Merrill, 1972.

Ramsey, et al. Modern Earth Science. Holt, Rinehart, Winston, 1979.

Spencer. Dynamics of the Earth. Crowell, 1972.

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2621 - Life Science

Bernstein, Schacter, Winkler, Wolfe. Concepts and Challenges in Life Science, Book 1. CEBCO Standard Publishing, 1974.

Bernstein, Schacter, Winkler, Wolfe. Concepts and Challenges in Life Science, Book 2. CEBCO Standard Publishing, 1975.

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Dolmats, Wong. Ideas and Investigations in Science. Prentice Hall, 1976.

Eisman, Tanger. Biology and Human Progress. Prentice Hall, 1972.

Fitzpatrick. Living Things. Holt, Rinehart, Winston, 1977.

Fogarish, et al. Project Me = Us. LAUSD, 1980.

Heimler, et al. Focus on Science Modules. Merrill, 1977.

Heimler, Lockard. Focus on Life Science. Merrill, 1977.

Himes. Solving Problems in Chemistry. Merrill, 1975.

Kasel, et al. Biology, An Everyday Experience. Merrill, 1981.

Kroeber, Wolf, Weaver. Biology. D. C. Heath, 1965.

Magnoli, et al. Experiences in Life Science. Laidlaw, 1983.

Oxenhorn. Pathways in Biology, Revised. Globe, 1979.

Richardson, Harris, Sparks. Life Science. Silver Burdett, 1982.

2623 - Physiology

Anthony. Anatomy and Physiology. Mosby Company, 1975.

Cornett, Gratz. Modern Human Physiology. Holt, Rinehart, Winston, 1982.

D'Amour. Basic Physiology. University of Chicago Press, 1961.

De Coursey. The Human Organism. McGraw Hill, 1974.

Evans. Anatomy and Physiology. Prentice Hall, 1976.

Kroeber, Wolf, Weaver. Biology. D. C. Heath, 1965.

McClintic. Physiology of the Human Body. John Wiley and Sons, 1978.

Neilson, Bland, Hill. Healthful Living in Your Environment. Laidlaw, 1972.

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Solomon, Davis. Understanding Human Anatomy and Physiology. McGraw-Hill, 1978.

Tortora, Anagnostakos. Principals of Anatomy and Physiology. Canfield Press (Harper Row), 1978.

2626 - Science, Gifted and Talented

Lane. Western Garden Book. Sunset, 1979.

2698 - Other

Felice, Carolan. Tune in to Health, Third Edition. CEBCO Standard Publishing.

Heimler, et al. Life Science Modules: Microbes and Disease. Merrill, 1977.

Otto, et al. Modern Health. Holt, Rinehart, Winston.

Pallock, Purdy, Carroll. Health--A Way of Life. Scott Foresman, 1979.

Perry. Marine Biology. Santa Monica College, 1975.

Reish. Marine Life in Southern California. Forty-Niner Shops, 1972.

Richmond, Fricke, Pounds, Jenkins, Russdorf. Health and Growth Series. Scott Foresman, 1974.

Zimbardo. Psychology and Life. Scott Foresman, 1977.

Table 9

Lesson Number in Which Topics in the Academic Senates' Competencies Statement Were Introduced

Topic	Houghton-Mifflin Struct. & Method 1981			Houghton-Mifflin Algebra 1 1980			HBJ 1977	Harcourt Brace, Jovanovich 1983		
	Min.	Ave.	Max.	Min.	Ave.	Max.	Ave.	Min.	Ave.	Max.
COURSE TOPICS INCLUDED IN COMPETENCIES STATEMENT										
1. Arithmetic oper. with + and - rational numbers	12	10	9	12	12	12	11	6	3	3
2. Arithmetic operations with literal symbols	1	1	1	1	1	1	17	1	1	1
3. Linear equations and their graphs	26	24	21	31	29	29	22	28	24	21
4. Inequalities	138	128	114	50	47	45	27	45	38	34
5. Ratio, proportion; direct and inverse variation	94	88	78	68	65	61	28	62	50	49
6. Operations with integer exponents	40	38	33	108	103	95	59	86	85	73
7. Operations with polynomials and rational expressions	41	39	34	91	85	80	77	93	91	79
8. Systems of linear equations and their solutions	114	100	91	63	60	56	49	69	63	52
9. Special products and factoring	65	62	56	97	92	87	85	107	101	88
10. Solution of quadratic equations	72	69	63	103	98	90	103		157	143
11. Use of formulas	6	5	5	47	44	43	142	4	6	6
12. Problem solving, involving:										
• integers	34	32	28	54	52	56	28	34	27	24
• time-rate-distance (constant motion)	49	47	42	58	55	52	28	65	60	47
• money	32	30	26	40	38	38		38	31	26
• geometry (area, perimeter, volume)	34	32	28	56	53	51	28	40	33	27
• age	34	32	28	54	52	56	29	52	41	33
• mixtures	104	95	84	60	57	54		75	65	56
• two unknowns	119	109	96	85	78	72		77	66	57
• quadratics	74	70	65	104	100	92	113		164	149
• work	94	87	78	127	121	113	29	115	106	92
COURSE TOPICS NOT INCLUDED IN COMPETENCIES STATEMENT										
13. Rational and irrational numbers; radicals	148	138	124	136	127	119	67	142	140	128
14. Properties (and their proofs) of real numbers				22	21	21	154			
15. Linear and quadratic functions	128	118	104	64	61	57	96			
16. Systems of linear equations in three unknowns				82	77					
17. Graphs of linear inequalities					75	58				
18. Plane geometry			148							
19. Trigonometric functions; vectors						140	147			153
20. Statistics and probability					148	150				
21. Linear programming						76				
22. Scientific notation							66			
23. Computer programming							164			

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Table 10
Percentage of Textbook Lessons for Each Topic in the Academic Senates' Competencies Statement

Topic	Houghton-Mifflin Struct. & Method 1981			Houghton-Mifflin Algebra 1 1980			HBJ 1977	Harcourt, Brace, Jovanovich 1983			
	Min.	Ave.	Max.	Min.	Ave.	Max.	Ave.	Min.	Ave.	Max.	Ave. %
COURSE TOPICS INCLUDED IN COMPETENCIES STATEMENT											
1. Arithmetic oper. with + and - rational numbers	6.8	6.8	5.4	5.2	4.3	2.5	3.9	2.6	1.9	1.9	4.1
2. Arithmetic operations with literal symbols	2.3	2.3	2.2	9.1	9.0	9.1	3.9	11.1	8.1	7.1	6.4
3. Linear equations and their graphs	12.8	12.4	10.8	3.3	3.1	3.1	10.7	9.8	10.6	11.0	8.8
4. Inequalities	6.0	6.0	5.8	2.6	3.1	2.8	1.1	3.3	3.1	2.6	3.6
5. Ratio, proportion; direct & indirect variation	5.3	5.7	4.7	4.6	2.4	2.6	3.9	2.7	2.5	3.2	3.7
6. Operations with integer exponents	1.5	0.8	0.7	2.0	1.5	1.9	2.8	4.6	3.7	3.9	2.3
7. Oper. with polynomials and rational expressions	15.5	12.4	9.0	9.7	9.9	9.7	12.9	12.5	10.6	9.1	11.1
8. Systems of linear equations and their solutions	3.4	3.0	4.0	11.0	8.7	7.8	5.1	3.3	3.1	3.2	5.3
9. Special products and factoring	4.5	4.5	4.3	3.9	3.7	1.9	4.5	9.2	6.2	5.8	4.9
10. Solution of quadratic equations	1.5	4.5	5.4	3.3	2.8	2.8	5.6	0.0	3.7	3.9	3.3
11. Use of formulas	1.5	0.8	0.7	0.6	0.6	0.6	1.1	2.0	1.9	1.9	1.2
12. Problem solving, involving:											
• integers	2.1	2.1	1.3	1.0	0.3	0.3	1.9	5.3	5.0	3.9	2.3
• time-rate-distance (constant motion)	0.8	0.8	0.7	1.3	1.2	1.3	1.7	1.3	1.9	1.9	1.3
• money	1.3	1.3	1.3	1.3	1.2	0.9	0.0	2.6	2.5	1.3	1.4
• geometry (area, perimeter, volume)	1.3	1.3	0.9	2.6	2.5	1.6	0.2	3.3	3.7	1.9	1.9
• age	0.9	0.9	0.9	0.3	0.3	0.3	0.6	0.7	0.6	0.6	0.6
• mixtures	0.8	0.8	0.4	2.0	1.9	1.6	0.0	2.6	1.9	1.3	1.3
• two unknowns	1.5	1.5	1.4	2.6	2.5	2.5	0.0	0.7	0.6	0.6	1.4
• quadratics	2.3	3.0	1.8	1.3	1.2	1.3	1.1	0.0	1.3	1.3	1.5
• work	1.5	1.5	1.1	0.6	0.6	0.6	1.4	0.3	0.9	1.0	1.0
Total % for problem solving	12.4	13.2	9.7	13.0	11.8	10.3	6.8	16.7	18.4	13.9	12.6
Total % of lessons related to Competencies Statement	73.6	72.2	62.6	68.2	61.0	55.0	62.3	77.7	73.8	67.6	67.4
COURSE TOPICS NOT INCLUDED IN COMPETENCIES STATEMENT											
13. Rational and irrational numbers; radicals	7.6	7.5	7.2	9.1	6.8	6.9	5.6	5.9	8.7	8.4	7.4
14. Properties (and their proofs) of real numbers	0.0	0.0	0.0	4.6	4.3	4.4	4.5	0.0	0.0	0.0	1.8
15. Linear and quadratic functions	2.3	2.3	2.2	2.6	3.1	3.1	3.9	0.0	0.0	0.0	1.9
16. Systems of linear equations in three unknowns	0.0	0.0	0.0	0.0	0.6	1.3	0.0	0.0	0.0	0.0	0.2
17. Graphs of linear inequalities	0.0	0.0	0.0	0.0	0.0	0.6	0.6	0.0	0.0	0.0	0.1
18. Plane Geometry	0.0	0.0	4.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
19. Trigonometric functions; vectors	0.0	0.0	4.7	0.0	0.0	5.0	6.7	0.0	0.0	5.8	2.2
20. Statistics and probability	0.0	0.0	0.0	0.0	6.8	5.6	0.0	0.0	0.0	0.0	1.2
21. Linear programming	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.0	0.1
22. Scientific notation	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.1
23. Computer programming	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0.0	0.0	0.2
Total % of lessons for additional topics	9.8	9.8	18.7	16.3	21.6	27.5	24.2	5.9	8.7	14.2	15.7
Review and Testing	16.6	18.0	18.7	15.5	17.4	17.5	13.5	16.4	17.5	18.2	16.9
Total % Lessons	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 11

Sample Problems for Algebra I Topics
in the Academic Senate Compenticies Statement

1. Arithmetic operations with positive and negative rational numbers.

   (a) Find $-4.7 + 5.3$

   * (b) Find $1\frac{9}{10} - 7\frac{1}{2}$

   (c) Find $\left(-\frac{2}{3}\right)\left(-\frac{6}{11}\right)$

   * (d) Find $-6 \div .6$

   (e) Find $-3 + |-7|$

   (f) Find $|-3 + -7|$

2. Arithmetic operations with literal symbols.

   (a) Simplify: $3a + b - a - 7b$

   * (b) Simplify: $\frac{2}{a} + \frac{3}{b} - \frac{5}{a}$

   (c) Evaluate $\frac{xy - w}{zx - y}$ if $x = 2$, $y = 3$, $w = 4$, $z = 5$

3. Linear equations and their graphs.

   (a) Solve: $4(3t + 2) - 5t = -4$

   (b) Solve: $\frac{3x}{4} + \frac{2x}{4} + \frac{9}{8} = 0$

   * (c) Solve: $\frac{2}{3x + 1} + 2 = \frac{2}{3}$

   (d) Solve: $\frac{5}{2x - 3} - \frac{8}{3 - 2x} = 1$

   (e) Graph $y = 2x + 1$

   (f) Solve $|2x - 1| = 3$

4. Inequalities.

   (a) Solve $3x - 1.4 < 2.2$

   * (b) Solve $4x - 1\frac{1}{2} \geq 2\frac{3}{4} + x$

   (c) Solve $-2x > 6$

Table 11 (continued)

5. Ratio, proportion, and variation.

   (a) If V varies inversely as the square of S and V = 512 when S = 30, find V when S = 40.

   * (b) If y varies directly as x and y is 36 when x is 4, find y when x is 6.

6. Operations with integer exponents.

   (a) Simplify $\dfrac{(5ab^2)(2a^3b)^2}{a^3b^2}$

   * (b) Express $(x^4y^{-3})(x^{-7}y^2)^{-1}$ without parentheses or negative exponents.

   (c) Express $\dfrac{x^{-2}y^3z}{x^{-1}y^{-2}z}$ without negative exponents and simplify.

7. Operations with polynomials and rational expressions.

   (a) Expand $(2x + 3)^2$

   * (b) Expand $(x^2 - 3x + 5)(2x - 1)$

   (c) Simplify: $\dfrac{18x^2y^3 - 12x^4y + 15x^3y^2}{3xy}$

   (d) Simplify: $\dfrac{x^2 + 2x + 1}{5x - 5} \cdot \dfrac{15}{x + 1}$

   * (e) Simplify: $\dfrac{2}{x^2 - 9} + \dfrac{1}{x + 3} - \dfrac{3}{x - 3}$

   (f) Simplify: $\dfrac{\dfrac{x}{x^2 + 6x + 9}}{\dfrac{x^2}{x + 3}}$

   (g) Simplify: $\dfrac{\dfrac{2}{a} + \dfrac{1}{4a}}{a + \dfrac{a}{4}}$

Table 11 (continued)

8. Systems of linear equations and their solutions.

* (a) Graph $2x + 3y = 6$ and $x - y = 3$ and find their point of intersection.

(b) Find x and y: $\begin{cases} 3x + y = 4 \\ 2x - 3y = 10 \end{cases}$

9. Special products and factoring.

(a) Factor completely: $27x^3 - 3x$

* (b) Factor completely: $3x^2 + 20x + 12$

10. Solution of quadratic equations.

(a) Solve: $49x^2 - 25 = 0$

* (b) Solve: $x^2 + 3x - 2 = 0$

11. Use of formulas.

(a) Find an expression for the area of a triangle whose base measures $6x$ and height measures $8y$.

* (b) If the diameter of a circle is a and its circumference is 20 cm., find the circumference of a circle whose diameter is $\frac{3}{2}a$.

(c) If the volume of a cube is 27 cm^3, find the length of one side.

12. Elementary word problems.

(a) The base of a rectangle is twice the height. If the area is $98 cm^2$, find the dimensions.

(b) Veronica leaves home walking at 3 miles per hour. One half hour later, her mother goes after her walking at 4 miles per hour. Find how long it will take her mother to catch up with her.

* (c) A company currently owns a copy machine that takes 5 hours to print 5,000 copies of a newsletter. If the company buys a second copier that prints 1,500 copies per hour and uses both machines, how long will it take to print these newsletters?

Table 12

Item Comparisons Among the Competencies Statement, Textbooks and Sample SAT Problems

Competencies Statement	Textbook Instruction	Sample SAT Problems
Arithmetic Operations with Literal Symbols		
Evaluate $\frac{xy - w}{zx - y}$ if $x=2$, $y=3$, $w=4$, $2=5$	Evaluate $x^2 - 2xy + y^2$ if $x=4$ and $y=-3$	$ab - 2cd = p$ $ab - 2cd = q$ $6cd - 3ab = r$ $\frac{p}{r} = ?$
Arithmetic Operations with + and - Rational Numbers		
Find $-4.7 + 5.3$	$x = 1.6 - 6.8 + 8.4$	Mr. A owes Mr. B \$70 and Mr. B owes Mr. A \$60. If Mr. A gives Mr. B a \$50 bill, how many dollars in change should Mr. B give Mr. A?
Direct and Inverse Variation		
If y varies directly as x and y is 36 when x is 4, find y when x is 6.	If y varies directly as x, and y = 300 when x = 3 , find y when x = 10.	$42:63 = 28:x$ $x = ?$